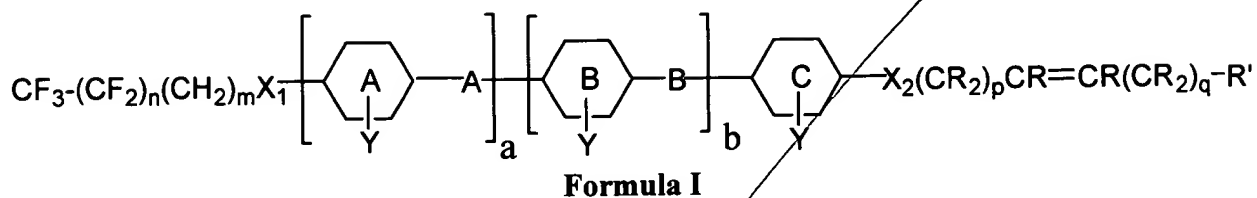


We claim:

1. A liquid crystal composition comprising one or more compounds of the formula:



wherein:

a and b are 0 or 1;

A and B, independently, are selected from the group consisting of a single bond, -COO-, -OOC-, -CH<sub>2</sub>-CH<sub>2</sub>-, -OCH<sub>2</sub>-, -CH<sub>2</sub>-O-, -CH=CH- (cis or trans); -C≡C-, -CH=CH-CH=CH- (cis or trans);

Y represents up to four substituents on a given ring where the substituents are selected from a halogen, CN or NO<sub>2</sub>;

Core rings A, B and C can be aromatic or alicyclic, if aromatic one or two ring carbons can be replaced with a heteroatom or if alicyclic rings can contain 3-10 carbon atoms and optionally can contain a double bond, wherein one or two CH<sub>2</sub> of the alicyclic ring can be replaced with O or a C=O group;

m and n are integers ranging from 1 to 20, inclusive; p is an integer ranging from 2 to 20, inclusive; q is 0 or an integer ranging from 1 to 20; inclusive; n + m is 4 to 20 and p + q is 4 to 20;

X<sub>1</sub> and X<sub>2</sub>, independently, are -O- or a single bond; and

R and R', independent of other R or R' in the alkenyl tail are hydrogens or alkyl groups.

2. The liquid crystal composition of claim 1 wherein the compound of formula I has a core selected from the cores listed in Scheme 1.

A 3. The liquid crystal composition of claim 1 wherein the compound of formula I has a phenyl pyrimidine core.

4. The liquid crystal composition of claim 1 that exhibits a smectic C phase.

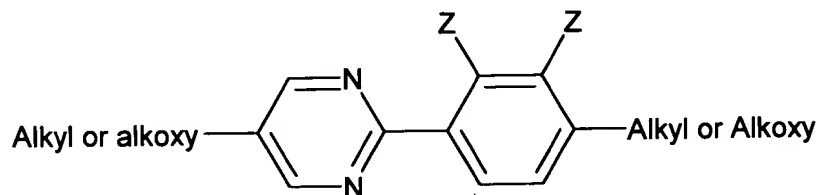
5. The liquid crystal composition of claim 4 wherein the smectic C phase extends over a temperature range of 50°C or more.

6. The liquid crystal composition of claim 4 that further exhibits a smectic A phase.

7. The liquid crystal composition of claim 1 which comprises two or more compounds of formula I.

8. The liquid crystal composition of claim 1 which comprises three or more compounds of formula I.

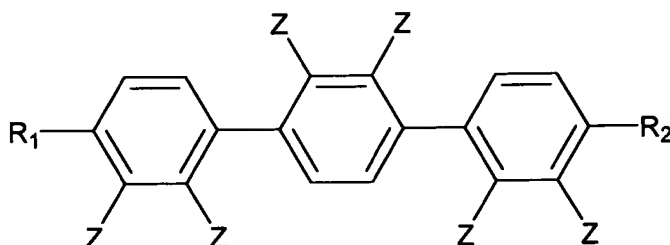
X 9. The liquid crystal composition of claim 1 further comprising one or more compounds of formula:



where Z can be CH or CF and the alkyl or alkoxy tails can be straight-chain or branched and

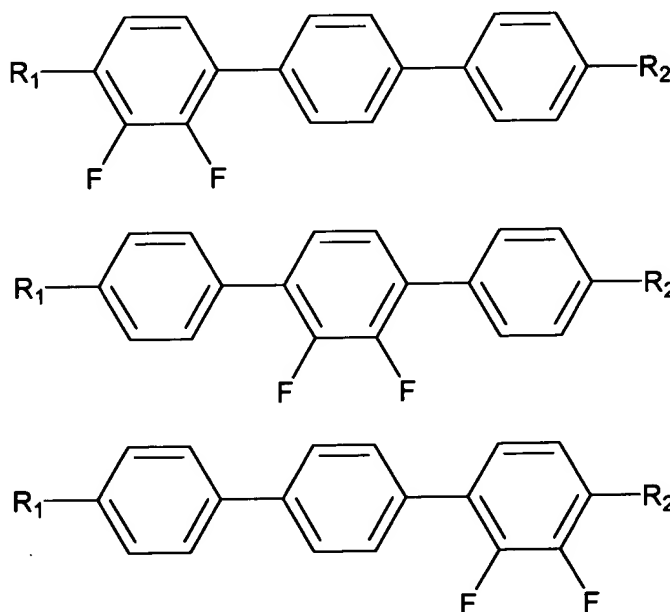
contain from three to twenty carbon atoms.

10. The liquid crystal composition of claim 1 further comprising one or more compounds of formula:



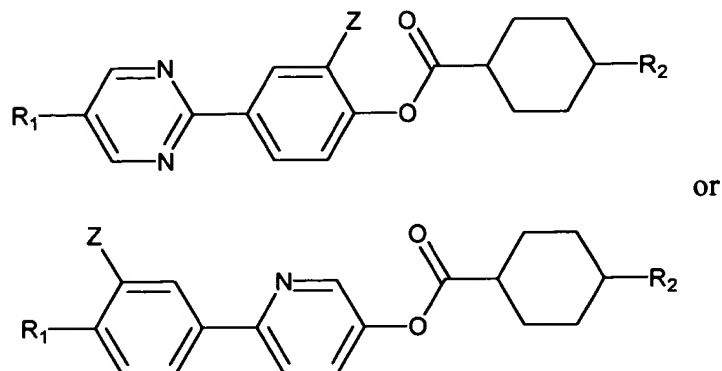
where CZ is CH or CF and R1 and R2 are alkyl or alkoxy groups having from three to twenty carbon atoms.

11. The liquid crystal composition of claim 10 which comprises one compound of each of the formulas:



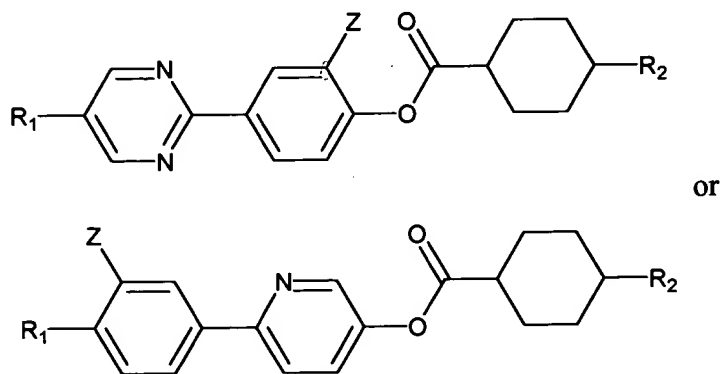
wherein R<sub>1</sub> and R<sub>2</sub> are alkyl or alkoxy groups having from three to twenty carbon atoms and R<sub>1</sub> is not the same as R<sub>2</sub>.

12. The liquid crystal composition of claim 1 further comprising one or more compounds of formulas:



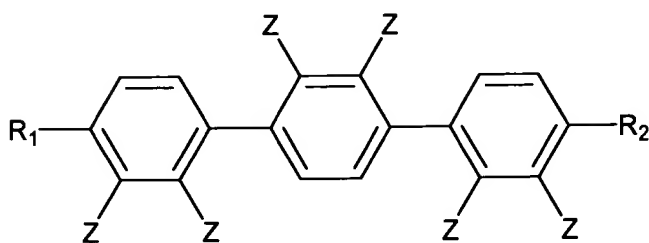
where CZ is CH or CF and R<sub>1</sub> and R<sub>2</sub> are alkyl or alkoxy groups having three to twenty carbon atoms.

13. The liquid crystal composition of claim 9 further comprising one or more compounds of formulas:



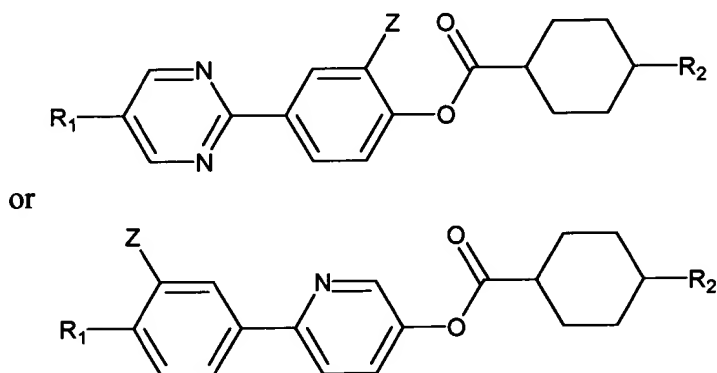
where CZ is CH or CF and R<sub>1</sub> and R<sub>2</sub> are alkyl or alkoxy groups having three to twenty carbon atoms.

14. The liquid crystal composition of claim 9 further comprising one or more compounds of formula:



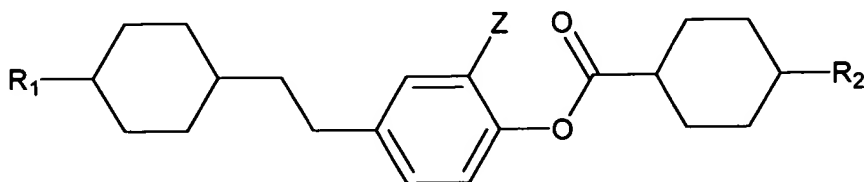
where CZ is CF or CH and  $R_1$  and  $R_2$  are alkyl or alkoxy groups having from three to twenty carbon atoms.

15. The liquid crystal composition of claim 14 further comprising one or more compounds of formula:



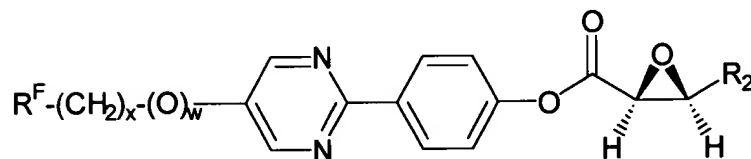
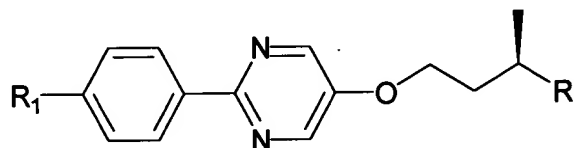
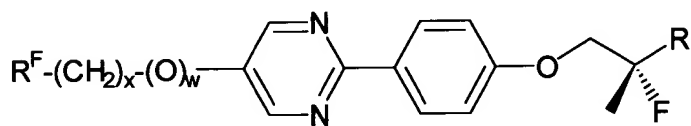
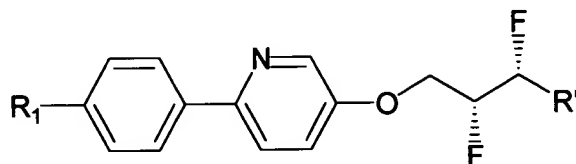
wherein CZ is CH or CF and  $R_1$  and  $R_2$  are alkyl or alkoxy groups having from three to twenty carbon atoms.

16. The liquid crystal composition of claim 15 further comprising one or more compounds of formula:



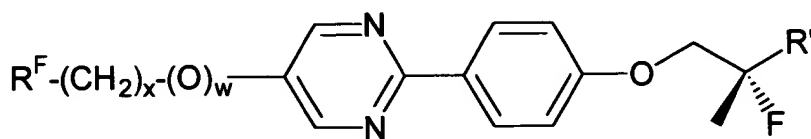
$R_1$  and  $R_2$  are alkyl or alkoxy groups having from three to twenty carbon atoms.

17. The liquid crystal composition of claim 1 further comprising one or more compounds of formulas:



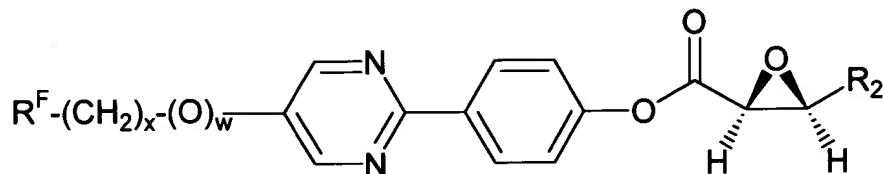
where:  $w$  is 0 or 1;  $x$  is an integer ranging from one to twenty;  $R_1$  is an alkyl or alkoxy group having three to twenty carbon atoms;  $R_2$  is an alkyl group having from three to twenty carbon atoms;  $R'$  is an alkyl group having three to twenty carbon atoms; and  $R^F$  is a perfluoroalkyl group having from one to twenty carbon atoms.

18. The liquid crystal composition of claim 1 further comprising one or more compounds of formula:



where: w is 0 or 1; x is an integer ranging from one to twenty; R' is an alkyl group having three to twenty carbon atoms; and R<sup>F</sup> is a perfluoroalkyl group having from one to twenty carbon atoms.

19. The liquid crystal composition of claim 1 further comprising one or more compounds of formula:



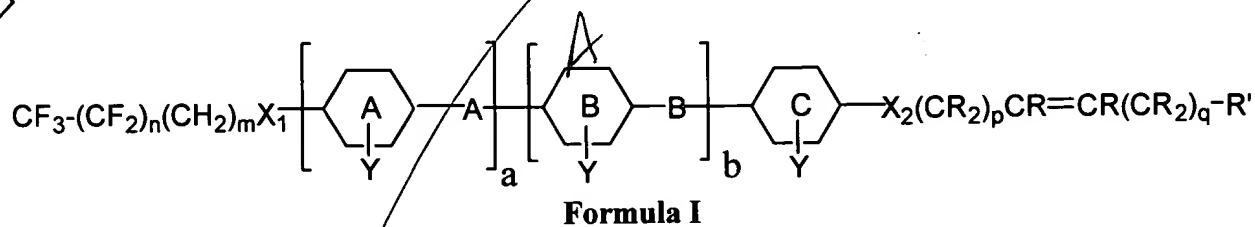
where: w is 0 or 1; x is an integer ranging from one to twenty; R<sub>2</sub> is an alkyl group having from three to twenty carbon atoms; and R<sup>F</sup> is a perfluoroalkyl group having from one to twenty carbon atoms.

20. The liquid crystal composition of claim 1 which exhibits a freezing point of -60°C or less.

21. The liquid crystal composition of claim 1 which exhibits both a smectic C and a smectic A phase.

22. The liquid crystal composition of claim 20 which further exhibits a freezing point of -60°C or less.

23. A LC compound having the formula:



wherein:

a and b are 0 or 1;

A and B, independently, are selected from the group consisting of a single bond, -COO-, -OOC-, -CH<sub>2</sub>-CH<sub>2</sub>-, -OCH<sub>2</sub>-, -CH<sub>2</sub>-O-, -CH=CH- (cis or trans); -C≡C-, -CH=CH-CH=CH- (cis or trans);

Y represents up to four substituents on a given ring where the substituents are selected from a halogen, CN or NO<sub>2</sub>;

Core rings A, B and C can be aromatic or alicyclic, if aromatic one or two ring carbons can be replaced with a heteroatom or if alicyclic rings can contain 3-10 carbon atoms and optionally can contain a double bond, wherein one or two CH<sub>2</sub> of the alicyclic ring can be replaced with O or a C=O group;

m and n are integers ranging from 1 to 20, inclusive; p is an integer ranging from 2 to 20, inclusive; q is 0 or an integer ranging from 1 to 20; inclusive; n + m is 4 to 20 and p + q is 4 to 20;

X<sub>1</sub> and X<sub>2</sub>, independently, are -O- or a single bond; and

R and R', independent of other R or R' in the alkenyl tail are hydrogens or alkyl groups.

24.

1.

The liquid compound of claim 23 having a core selected from the cores listed in Scheme

25. The liquid crystal compound of claim 23 which has a phenyl pyrimidine core.

26.

core.

The liquid crystal compound of claim 23 which has an optionally substituted terphenyl



27. The liquid crystal compound of claim 23 wherein  $X_1$  is an oxygen.

~~28.~~ The liquid crystal compound of claim 23 wherein  $X_2$  is a single bond.

29. The liquid crystal compound of claim 23 wherein the double bond in the alkene tail is a cis double bond.

30. The liquid crystal compound of claim 23 wherein the double bond in the alkene tail is a trans double bond.

31. The liquid crystal compound of claim 23 wherein the core contains two aromatic rings.

~~32.~~ The liquid crystal compound of claim 23 wherein the core contains a cyclohexane ring.

33. The liquid crystal compound of claim 23 wherein  $m + n$  ranges from 5 to 12.

34. The liquid crystal compound of claim 23 wherein  $n$  is 3 and  $m$  is 4.

35. The liquid crystal compound of claim 23 wherein the core is a phenylpyrimidine which is optionally substituted with one or two fluorines on the phenyl ring.

112 ~~36.~~ The liquid crystal compound of claim 34 wherein  $m + n$  ranges from 5 to 12.

37. The liquid crystal compound of claim 34 wherein  $m + n$  ranges from 8 to 12.

38. The liquid crystal compound of claim 36 wherein  $X_1$  is an oxygen atom.

112 ~~39.~~ The liquid crystal compound of claim 36 wherein  $X_2$  is a single bond.

40. The liquid crystal compound of claim 39 wherein  $p + q$  ranges from 5 to 12 and  $R'$  is a methyl group.

~~41.~~ The liquid crystal compound of claim 39 wherein  $q$  is zero and  $R'$  is a hydrogen.

~~42.~~ The liquid crystal compound of claim 39 wherein  $p$  is 3-6 inclusive and  $q$  is 3-6, inclusive, and  $R'$  is a hydrogen or a methyl group.

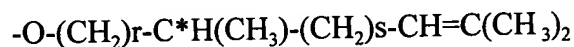
~~43.~~ The liquid crystal compound of claim 39 wherein the double bond in the alkene tail is a cis double bond.

~~44.~~ The liquid crystal compound of claim 39 wherein the double bond in the alkene tail is a trans double bond.

~~45.~~ The liquid crystal compound of claim 23 wherein the alkene tail is a chiral nonracemic moiety.

~~46.~~ The liquid crystal compound of claim 45 wherein in the alkene tail one  $R$  bonded to the third to the fifth carbon in the tail is a methyl group and the carbon to which the methyl group is bonded is an asymmetric carbon.

~~47.~~ The liquid crystal compound of claim 46 wherein the alkene tail has the formula:



where  $r$  is 2-6, inclusive and  $s$  is 2 to 6, inclusive.

~~48.~~ The liquid crystal compound of claim 47 wherein  $r$  is 2 and  $s$  is 2 to 4, inclusive.

~~49.~~ The liquid crystal compound of claim 48 wherein  $m + n$  ranges from 5 to 12, inclusive.

